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Professional paper

THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATION: SCIENCE CLASSES

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ABSTRACT

This article examines the use of information and communication technology (ICT) in teaching Science as well as the organisation and realisation of online classes during the ongoing COVID-19 pandemic. In respect to this, the research results are used to gather teachers' viewpoints and opinions regarding the application of ICT in Science classes, as well as to determine the best method of application of the aforementioned technologies and the form of ICT most often used in Science classes. The results are also used to gather teachers' opinions about online classes, and to examine the problems and disadvantages the teachers encountered when organising and holding online Science classes for the lower grades of elementary schools in Bosnia and Herzegovina during the COVID-19 pandemic. The results of the research also illustrate that teachers have a positive opinion in regards to the use of ICT in Science classes as well as the frequent (albeit not constant) use of it. The teachers not only consider themselves competent enough to apply all forms of new technologies in their classes, but express the will and motivation for further education related to ICT application as well. On the other hand, teachers do not have a positive opinion about online classes due to the many difficulties they encounter, such as technical issues, inteference by parents, lack of direct contact with students, the inability to monitor their progress and the general deficiency of equipment needed to incorporate ICT into regular classes, as well as other difficulties of a similar nature. However, the research results also show that teachers believe new technologies are connected to the development of new skills and the improvement of students' existing skills.

Keywords: information and communication technology (ICT), online classes, COVID-19, Science classes, skills and abilities of teachers.

INTRODUCTION

In the midst of the coronavirus pandemic (COVID-19) in all parts of the world, including Bosnia and Herzegovina, online classes have become a necessity and a way of learning without an alternative. Traditional teaching had to be ceased in order to prevent the spread of infection and preserve the health of participants in the teaching process. As technology has advanced greatly in the past two decades, it has become possible to move the teaching process to an online environment. The use of technology has impacted all the other fields of society as well, both economic and business relations. The expansion of information technology took place as early as the 1990s, with the invention of floppy disks for storing important data, newer, smaller and more compact computers and CD-ROMs, which contained teaching materials. All these forms of technology were not used to such an extent in the teaching process, but a difference and a shift could be noticed in relation to the teaching that had been dominating the teaching process for centuries. After the development and application of information technologies, a new type of teaching was discovered, and that was teaching that applied information-communication technology (ICT) for the development of students' abilities, and which with globalization and digitalization arousal in the world has become of increasing importance. The goal is to raise and educate students for tomorrow, in congruence with the principles and rules of the future, not for the past and present, so education will have to find a way to deal with all the new information, techniques and technologies that the future will provide. Suzić believes that the continuous forcing of the content and working methods of the past, along with remembering the successes of past students, who worked with traditional teaching methods, harms the school (Suzić, 2005), and thus prevents it from devoting itself to the education of the future. Modern teaching therefore requires a lot from both the teacher and the students who are sometimes even more adept to the use of the new technologies than their teachers, and thus it is concluded that both will encounter many problems during the implementation of ICT, but they will also need to adhere to certain conditions in order to make the newly found situation and application of technologies easier for each other. However, in order for teaching to be considered modern, it is not enough to provide students with technology and consider that their educational process is over. Ćatić considers modern teaching as a certain task, something that will encourage students to work and help teachers create more modern teaching (Ćatić, 2003), so the teacher should leave the choice of topic to students, supervise their deliberations and agreements. The teacher will give them a chance to say what they

think, and thus show how much he/she cares about their attitude and opinion. The students' involvement is the most important in teaching after all, and the only method that will bring good results, and since ICT provides great opportunities for research, students will certainly be able to show enviable results. The whole process seems extremely easy. Even so, it must be taken into account that ICT is a complex process, because technological innovation will be encouraged only in those institutions that support change in different ways (Crnjac Milic et al., 2009). It is for this reason that the new technology comes with certain goals and tasks, and the most important is the active involvement and learning, student participation in the teaching process which will lead to the student becoming a subject in teaching and not merely an object of teaching. This will result in students who will work actively and will not hesitate to search for and work with data, but apply this data in their assignments. This approach can make the work easier for the teacher (Lukša et al., 2014). Students need to be taught how to learn and reason, and this is the goal of new technologies and modern teaching, so they will participate more actively in classes, learn how to research, recognize and evaluate the information and data they need to create school assignments, and develop their critical thinking with regards to available information. This is another goal to be achieved through the use of ICT and online teaching. In order for teachers to achieve these goals, they need to have certain competencies and skills that will make them go further toward this goal. Modern teachers are required to find new and creative ways to encourage students to think and accept other people's beliefs, as well as to nurture alternative ways of learning, such as learning using ICT. Moreover, teachers need to be experienced mentors to their students and help them improve and reshape their beliefs and worldviews (Matijević, 2017). The modern teacher should be a guide who will talk to students about how to improve their work and make it better, and thus enable the educational environment to become more pleasant. Teachers should be educated, and most importantly informed individuals who will keep up with the development of technologies, methods and work strategies and their application in the teaching process, in order to expand their viewpoints and understand the importance of lifelong education and advancement. Rustempašić (2018) points out that the teacher should be the organizer of the learning process and motivator, the one who will encourage students to think critically, who will guide and support them in the learning process and who will not allow classrooms to become *fast food restaurants where students will be offered ready-to-eat meals*. Jensen (2003) believes that teachers should have the role of coaches who can discover talents, but also direct students to the path of learning and not to the mere memorisation of information, while Lasić (2015) states that teachers should be

mentors with their own critical and creative thinking, prosocial thinking and an opinion that is focused on society and the future. If teachers have all the listed competencies and characteristics, and are familiar with the roles they need to play in the teaching process, but are not sufficiently educated to apply ICT in classes, they are less likely to make students well-prepared for the future. A quality teacher in a modern school should show students how to cope and survive in the world to come, let students choose the way they will learn, or show consideration for the method that seems best to them (Glasser, 1994), regardless of whether it means introducing innovations such as ICT in classes. Today, students are in the position to learn using technology, and the teachers' task will be to teach them how to do it in a quality way, provided, of course, that they know how to use and implement ICT in teaching. Continuing education and lifelong learning is an imperative of the teaching profession. A key direction of the European Union in the first decade of the 21st century is precisely the development of lifelong learning, and the concept of lifelong learning responds to the needs of the individual in a constantly changing modern society (Radeka, 2007). The Recommendation of the European Parliament and the Council (2006) on key competences for lifelong learning calls on European Union Member States' governments to make the teaching and learning of key competencies part of their lifelong learning strategies in the teaching profession. This recommendation contains eight key competencies of the modern teacher: communication in the mother tongue and foreign languages, basic competencies in mathematics, natural sciences and technology, digital competencies, and interpersonal and intercultural skills. In the age of globalization and digitalization, it is clear that digital competence is among the most important, due to the fact that in the near future, all content that could be used in teaching will be available on online platforms intended for teachers' training and support and to be used in classes. So, teachers should be asked to know how to adapt the curriculum to the time they live and work in to create the best learning environment possible (Jager, Lokman, 2000). Nowadays, there are many options for teacher education for the application of modern technologies, so Bulić and Novoselić (2016) believe that education for the application of ICT should be systematically introduced and incorporated in the formal education of future teachers because only a digitally competent teacher will be able to use ICT but also to create their own content such as multimedia presentations, interactive posters and knowledge assessment quizzes. If the aforementioned education is not done within formal education, teachers can easily be educated in other ways as well. For somewhat more complex teaching strategies and ICT techniques in teaching, teachers should undergo specialized trainings, with the purpose of teachers independently developing their

own techniques for applying new technologies in teaching (Vrkić-Dimić, 2014). Therefore, another option for education related to the application of ICT could be distance learning, i.e. online education. That is a form of education that enables course participants to start from the basics and provides them with various educational programs such as those related to computers in The Information Age, educational reforms or the education of the future society (Tinio, 2003). It is important to emphasize that not all teachers will use all forms of the new technology upon completing the course, but will use those that suit them best, just like any other techniques and strategies. For many teachers, not even a wide range of educational opportunities would be enough if they are not motivated to work, if they are not interested in new technologies at all, or if they are insecure about their own abilities when it comes to the application of ICT in the teaching process. In addition to the previously mentioned, Vilotijević (2001) talks about the following reasons for resistance to novelties: ignorance of the innovation, lack of essential resources and materials, maintenance of the existing situation, interpersonal relations, social norms, substitutions and obligations imposed by changes. As ICT influences teachers by changing their roles and competencies, improving skills and acquiring new knowledge, new technologies also affect students. The application of ICT affects different aspects of knowledge and its construction, and as more and more students use ICT in their learning process, this means that the said effect will become even more pronounced (Noor-ul-Amin, 2012). It is clear how the new technologies impact student development and education. ICT introduces more flexibility in learning, which means that students can access the information they need anytime and anywhere, which greatly affects the way students are taught. This concept will improve students' education and train them better for lifelong learning. Moreover, the accessibility also affects students with special needs, in a way that they can be educated without going through the difficulties that school can deliver to such a student. If the teachers use all the possibilities of ICT in the right way, they create a more creative and accessible learning space for students, which affects their motivation, giving them a basis for more research and better information handling, thus bringing students' competencies to a higher level. This use leads to the acquisition of new capabilities and qualities in students, which can be subsumed under those that Suzić (2005) states for teachers. However, when these and all other competencies are acquired, the teacher needs to be the student's mentor and perform the above roles.

In order to properly integrate ICT into regular classes, it is necessary to meet certain conditions, most important of which are: the teacher must believe in the effectiveness of technology, the use of technology will not cause any interference,

and finally it needs to be established that the teacher has control over technology (Cziko, as cited in Noor-ul-Amin, 2012). When introducing new technologies in teaching, it is important to have equipment that is operated effectively – this way any unwanted issues can be avoided easily. What is perhaps most important of all is the cooperation of teachers and the whole school with technology experts in order to achieve the best possible foundation for the use of technology in the teaching process (O'Donnell, 2015 as cited in Pejić-Papak and Grubešić Krmpotić, 2016). In order for the introduction of ICT to be successful, the following conditions must also be met: teachers and students must have sufficient access to digital technologies and the Internet in classrooms, schools and institutions that educate teachers, the digital content must be meaningful and of high quality, and the content must be appropriate to the culture and environment they live in. It must be accessible to teachers and students, teachers must possess the competencies and skills to handle new digital media and resources to give all students the opportunity to achieve the best possible academic success (Ratheeswari, 2018). If the aforementioned conditions are met and ICT is properly integrated into the teaching process, it will bring certain advantages such as space and time, which will allow the students to learn at any time, anywhere and at the pace that suits them best, intertwining practice and school, creating economic sustainability for students who will have their job in the future and the progress of the school itself (Noor-ul-Amin, 2012). New technologies additionally make the school accessible, in terms of infrastructure, for students with developmental difficulties, because it allows them to study from home and gives them a chance to develop their skills and competencies regardless of their own difficulties. The introduction of new technology in the teaching process also increases the performance of the school, because students can practice and improve the acquired competencies on examples, and acquire new ones that they will surely need one day. Presuming that ICT is combined with modern teaching methods, techniques and strategies, students will certainly be more actively involved in the teaching process in which their competencies will have the opportunity to develop. If ICT is used in teaching, students are given opportunities for active learning in which they become researchers and take responsibility for their own learning and achievements, which should eventually lead to more frequent experience of success, self-esteem, competence development and positive attitudes towards learning (Lukša et al., 2014). Another advantage of ICT is that it provides flexibility, meaning that if certain tasks cannot be performed using a type of technology – say, a computer, there is always the possibility of using smartphones in classes, where the necessary applications for certain subjects could be easily installed. The created data can

be used anytime and anywhere, which further creates the possibility of adapting the teaching content, which is realized faster and more efficiently, to all levels of students' knowledge and abilities. The use of modern technology achieves better communication between students and teachers, and teachers are more likely to opt for lifelong learning because they consider modern teaching familiar after using it for some time and are more willing to find ways to educate, regardless of space and time.

There is no way of working that does not have shortcomings, and that includes ICT and the integration of technology into the teaching process. The most frequent drawbacks that occur are: unavailability of content in the native language, problems with classroom equipment, lack of time in class, uneducated teachers and lack of motivation of teachers themselves for education. There is a lack and problem of social communication between teachers and students and among the students themselves. Finally, there is the danger of information lurking on the Internet, specifically the impossibility to filter it (Lukša et al., 2014). Podrug (2017) also agrees with the author, who claims that it is rare to find mobile applications that are appropriate for lower school age students. The student may even think that he/she is isolated due to the lack of direct contact with the mentor/teacher (Breslauer, 2011). Among the already mentioned problems and shortcomings of ICT are the ICT infrastructure of the school, which means that before launching any ICT-supported program, planning must ensure the availability of technology accommodation, which is often a problem for many teachers, as well as affordable online services for online or ICT-supported learning, and these facilities must also have access to telephony and electricity (Kumar, 2008). A significant problem is the excessive use of media in teaching because it can negatively affect students and the development of their basic skills, and even lead to addiction. If access to ICT is not provided to all participants in the process, it can cause more serious problems, such as the marginalization of those who are already endangered in economic and social terms. This was confirmed by the results of a research conducted in cooperation with the NGO COI Step by Step and Promente social research from Sarajevo. The research, conducted in the period April-May 2020 on a sample of close to 10,000 parents and students of the Sarajevo Canton, found that online teaching did not ensure one of the primary tasks of every education system – the right of every child to access to education and non-discrimination in the process of education. Online classes were not available to all students in the same way and with the same quality. According to the results of the research, access to online classes was conditioned by a number of other issues and difficulties in connection with attending online classes, which most often related to access and

use of technology – close to a quarter of the surveyed parents, 22.9 % of them, said that their children attended classes exclusively on their mobile phones, which certainly significantly limited the use of various web tools, the way of creating tasks and working in many programs and applications. Out of such a large research sample, 5.3 % of children had to wait for their parents to return from work to use their mobile phones, and this is far from negligible. An additional 27.8 % of children, according to the statements of the surveyed parents, share the equipment with their siblings and other family members, so their time for use is additionally limited. This fact is especially significant because it created difficulties in situations where students were given time-limited assignments and rigid deadlines to send assignments back. Moreover, when it comes to the difficulties they encountered during online classes, the largest number, as many as 45% of them, singled out a poor internet connection that interfered with, slowed down or disabled their work. Unfortunately, when it comes to children who have not been able to access online classes in complete or to a large extent, precise or at least publicly available data for Bosnia and Herzegovina is still nonexistent. Although this research was not in a position to obtain such data, nor to access this target group, it is important to stress that it exists and that everything must be done to ensure that each child has the minimum conditions to follow online classes.

Many authors consider that financial investments for the application of ICT in education and digital content that are not available in the native language are significant shortcomings. The question of the sustainability of new technologies in the teaching process is raised as well, even though the pandemic period proved them to be necessary. Yet we are witnessing that during the coronavirus pandemic (COVID-19) many online teacher groups emerged at all levels of education, creating their banks of ideas, digital materials and guidelines for the online teaching process.

RESEARCH METHODOLOGY

Research problem and research subject

The research problem is information and communication technology.

ICT has a large share in modern teaching, education and upbringing of students, as well as training them for lifelong learning. However, technology also represents a serious problem, a dilemma and a mystery to teachers who are not trained, at least not to a sufficient extent, to use it. If teachers want to progress and prepare students for the future and for their future workplace, they themselves should be trained and possess the competencies they want and need to teach. The

need for lifelong learning is an imperative of teachers' professional development. There is no quality education without quality teachers.

The research subject is the application of ICT in Science classes.

The research determines the extent to which teachers use ICT in regular Science classes, which forms of technology they most commonly use, what is their attitude towards this type of innovation in classes, whether it really improves students' work, develops skills and competencies, and what are the reasons against the use of ICT. Moreover, the teachers' opinion about online teaching, which was mandatory during the coronavirus pandemic (COVID-19) as a substitute for the traditional teaching process in classrooms, the problems they encountered during the implementation of online classes, and the biggest drawbacks of online teaching, based on teachers' opinion and experience, were investigated.

Research goal

The goal of this research is to obtain teachers' opinions and attitudes about ICT in the teaching of Science in regular classes and to examine teachers' opinions about online classes and to identify problems and deficiencies they encountered during the coronavirus pandemic (COVID-19).

Research tasks

According to the subject and the goal of the research, the following research tasks were set:

T_1: Determine whether teachers use information and communication technology and to what extent.

T_2: Determine whether teachers have a negative attitude towards online classes and whether they encounter problems when organizing and implementing it.

T_3: Determine whether teachers are sufficiently educated to apply ICT in Science classes, and whether they are motivated to further improve.

T_4: Establish the teachers' opinions regarding the equipment of schools with ICT.

T_5: Identify what the teachers use ICT for.

Research hypotheses

Based on the goal, problem and subject of the research, the following general hypothesis was established: teachers have mostly negative attitudes towards the application of ICT in the teaching of Science as well as towards the realization of online teaching.

In accordance with the general hypothesis, the following special hypotheses were set:

H_1: It is assumed that teachers do not use ICT enough in Science classes.
H_2: It is assumed that teachers have a negative attitude about online classes and encounter many problems in organizing and implementing them.
H_3: It is assumed that teachers feel that they are not sufficiently educated to apply ICT in Science classes, and their motivation for further training is low.
H_4: It is assumed that teachers consider schools to be insufficiently equipped to introduce ICT in regular classes.
H_5: It is assumed that the teachers who use ICT mainly use it to make presentations and watch videos with students.

Research techniques

The following techniques will be used for research purposes: surveys and the technique of assessment and evaluation.

The survey consisted of ten questions related to the use of ICT in Science classes, online teaching, and advantages and disadvantages of ICT. The scale of attitudes (technique of assessment and evaluation) consisted of nine statements regarding the teachers' attitudes towards ICT in Science classes, online classes, their own abilities for the application of ICT, the development of student abilities when using it. Also included in the scale are numbers indicating the degree to which teachers agree with a particular statement (1 – I don't agree at all, 5 – I completely agree). Teachers expressed their views by agreeing or disagreeing with the statements.

Respondents and research implementation

The online survey was conducted on a sample of 100 respondents – teachers, and the survey focused on the second semester of the 2019/2020 school year, for the period April – June during the COVID-19 pandemic. The research covered the following areas: Zenica – Doboj Canton (50), Sarajevo Canton (27), Central Bosnia Canton (13), Brčko District (6), Herzegovina – Neretva Canton (2), Tuzla Canton (1) and Una – Sana Canton (1). The majority of respondents that participated in the research were women, 92 of them, while the number of men responding to the survey was 8. The number of female respondents shows that the teaching profession is still considered predominantly female, just as it was in the previous years. However, it is necessary to understand that anyone can be a good teacher, regardless of gender, and the only requirement is progressing and investing in one's knowledge.

Results and discussion

The first chart shows the frequency of the use of ICT in the teaching about environment.

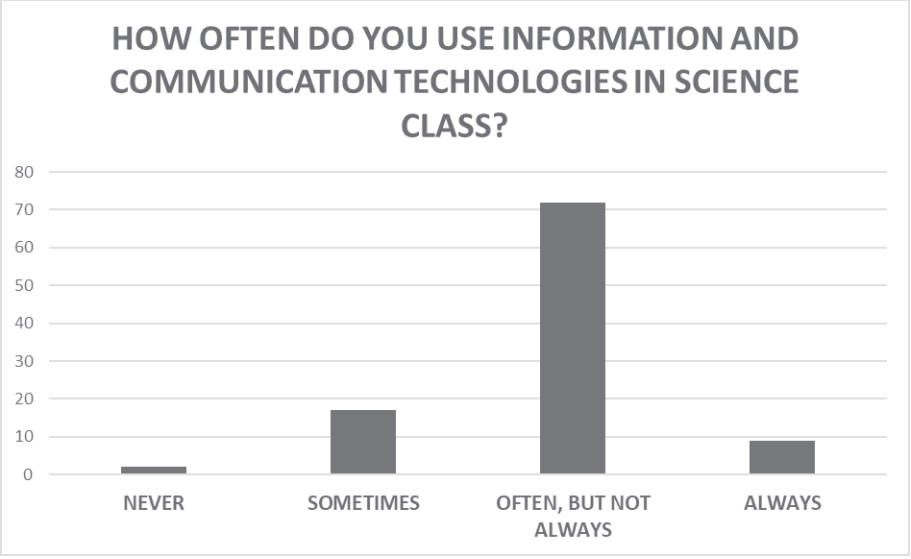

Chart 1 Use of information and communication technology in Science classes

When asked "*How often do you use information and communication technology in Science classes?"* 72 respondents answered that they used it often, but not always, 17 answered sometimes, while only 9 respondents always used ICT in Science class, and 2 never used it. Therefore, it can be concluded that most of the respondents oftentimes use ICT in Science classes.

Chart 2 shows the attitude of the respondents towards online teaching, while Charts 3 and 4 show the difficulties and shortcomings that the respondents encountered during the organization and implementation of online teaching.

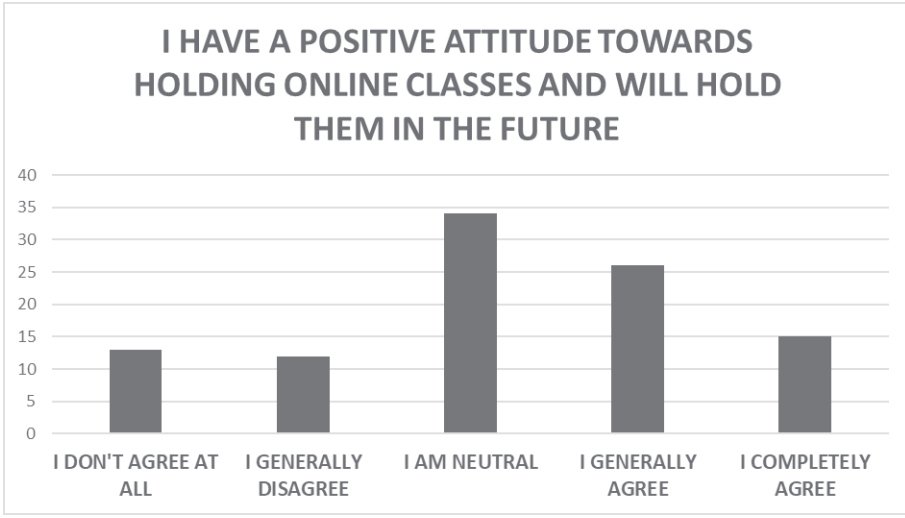

Chart 2 Attitude towards holding online classes

Online classes during the pandemic have suddenly become a necessity that is not easy to circumvent, and therefore teachers' attitudes about online teaching have become more important than ever. In respect to this, the majority of respondents, 41 of them, expressed a positive attitude towards online classes. A large number of respondents, 34 of them, expressed a neutral attitude towards this statement. There are 25 who disagreed with this statement, in whole or in part. Below we will give the reasons of respondents who did not support online teaching and examine whether this is due to the conditions which the schools operate in, the difficulties encountered by teachers in carrying it out or the simple inclination to traditional teaching. According to the research conducted by the NGO COI Step by Step in collaboration with the Community of Innovative Teachers and Promente Social Research (2020), most students attended classes through online platforms which leads to the conclusion that teachers really have positive attitudes towards online classes, since they had the motivation to learn how to conduct them through the platforms.

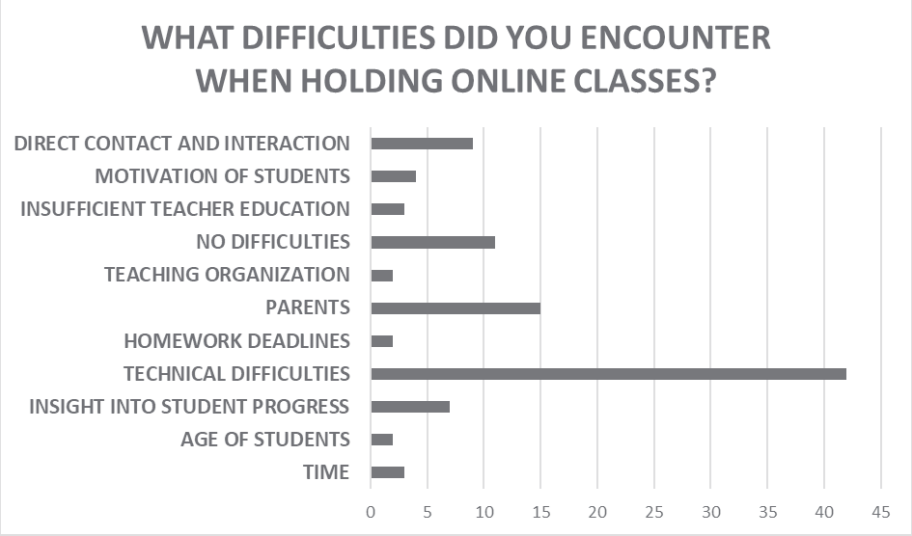

Chart 3 Difficulties in holding online classes

The theoretical part of this article already enumerated some difficulties encountered by teachers when using ICT, and the issue was not bypassed in this research either, where teachers were asked to list the difficulties they encountered when conducting online classes. Most of them (N = 42), cited technical difficulties such as outdated or broken equipment, inability to access video calling applications, and a lack of equipment that would allow them to connect better with students. A difficulty that was highlighted and that further made the online classes difficult was the inability of some students to attend online classes due to not having personal devices and had to wait to use their parents' mobile devices once they returned from work. Difficulties also occurred with primary school students, who could not access online classes on their own due to students' incapability to independently attend this type of classes, but there were also difficulties with parents doing work for students' assignments, and non-compliance with deadlines for assignments. The latter indicates difficulties related to working hours; some teachers sat for hours in front of their computers and mobile phones preparing, and students spent the same amount of time studying the above-mentioned content. Then there are difficulties linked to the lack of direct contact and interaction with students, insight into student progress, and lack of student motivation. A small number of teachers, three of them, believed that they were not educated enough for this type of teaching, and that theese classes were not well organized by the authorities. Only a few respondents, 11 of them, did not allow this type of teaching to discourage

and surprise them, so they stated that they had no difficulties in carrying online classes out. Rasmitadila et al. (2020) sets down four groups of difficulties that respondents encountered during online classes, namely: technical difficulties, student conditioning, student commitment, and online teaching experience. Out of all these difficulties, the authors pay the most attention to technical difficulties, which, in this study, have been shown to represent the biggest problem.

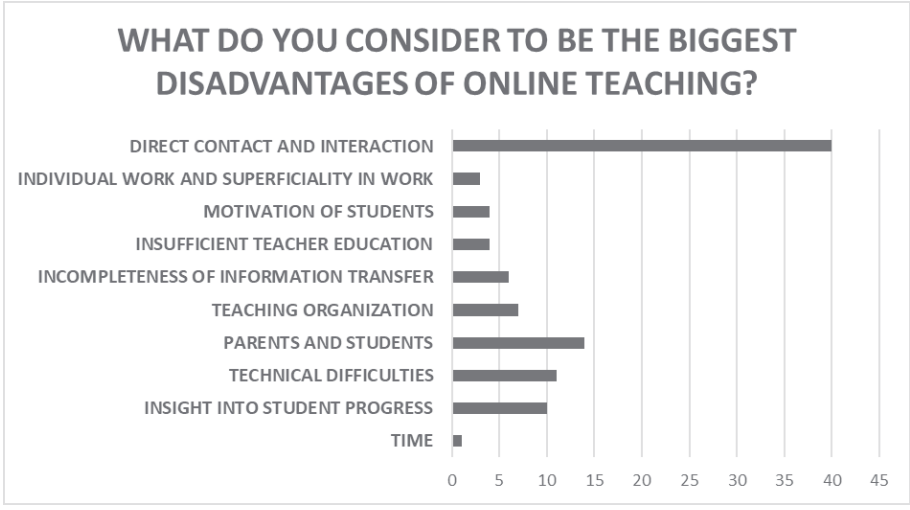

Chart 4 Disadvantages of teaching online

Problems and difficulties related to the organization of online classes, the transfer of teaching content into online forms and the search for the best methodological solutions occurred in parallel with the concerns for the health and lives of people we care about. It is important to be aware of the deficiencies so that in the future, if only online classes are to be held again, some of them will be improved and advanced, while it is necessary to understand that some of those deficiencies may never disappear, so the simplest thing would be to come to terms with it. When it comes to the most serious shortcoming of online classes, most respondents, 40 of them, stated the lack of direct contact, interaction and communication with students, especially with those students who have developmental difficulties. According to the respondents, online teaching also had the disadvantage that it was not possible to fully convey the content of the teaching unit – the lack of a direct conversation and the non-existence of a stable and unique platform for online teaching.

Chart 5 shows the self-assessment of teachers' abilities to apply all forms of ICT in Science classes, while the sixth chart shows the level of motivation for additional education when it comes to the use of ICT.

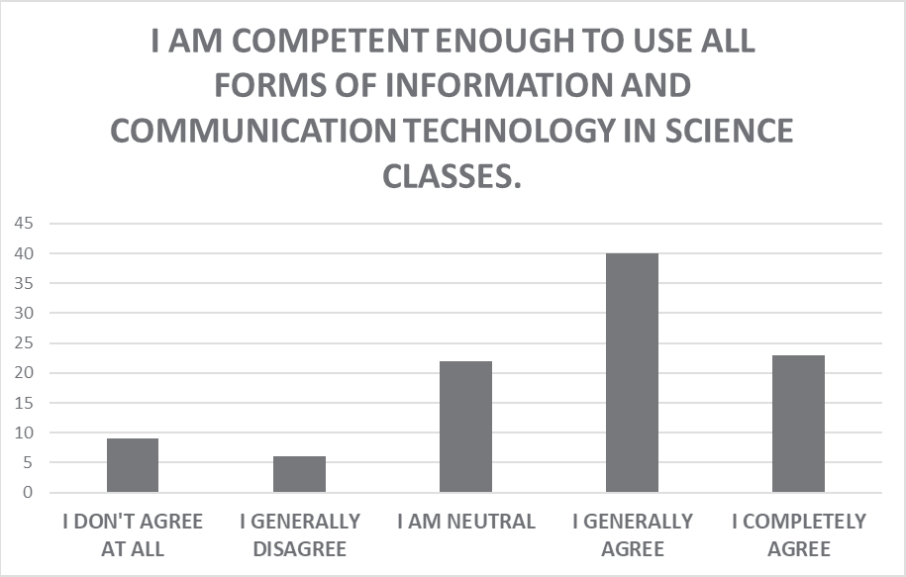

Chart 5 Competencies in usage of ICT in Science classes

Respondents, 63 of them, believe that they are mostly or completely competent to use all forms of ICT in Science classes, which leads to the question why then the respondents had technical difficulties or difficulties in finding content when conducting online classes. The same results are achieved by the NGO COI Step by Step (2020), because the results of their research show that teachers mostly used online platforms for classes, and knowledge how to use those platforms appears only through daily use of ICT in the teaching process and through readiness for lifelong learning, which means that teachers possessed digital competencies for the use of all forms of ICT in teaching.

Motivation is a very important factor in learning, especially in primary education students. If students are approached in a unique, simple and creative way, their motivation can be extended to a later age, in high school, college, and even to the age when they already get a job, but they know they need to be educated for new things to come. The same situation can happen with teachers and future teachers, because the end of college means only the end of formal education and the beginning of professional education. Professional development lasts until the end of the teacher's career. As many as half of the respondents, 50 of them, stated that they were fully motivated for additional trainings related to the application of ICT in teaching, while slightly more than 30 stated that they were largely motivated for such trainings. It can be concluded that teachers have positive attitudes towards the

application of ICT in teaching, but this type of improvement requires the support of institutions dealing with educational policies and continuing education that will be in the function of lifelong learning.

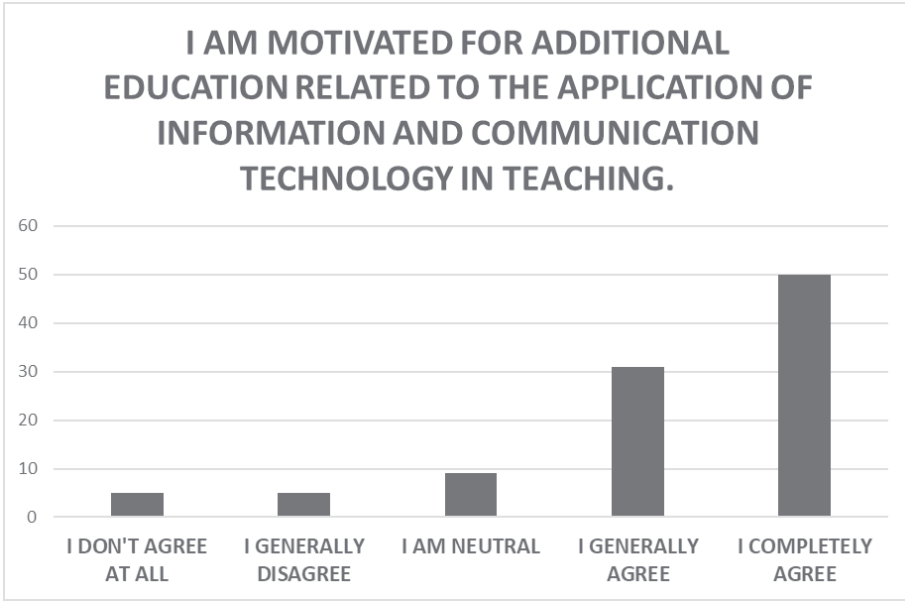

Chart 6 Motivation for additional education related to the application of ICT in teaching

Chart 7 shows teachers' attitudes towards equipping schools with ICT.

Schools in developing countries are not sufficiently equipped with modern technology that would allow the constant use of new forms of ICT and development and acquisition of new competencies, unlike schools in countries that have much more money and are willing to invest it in education. According to a research conducted in 2018, Germany – a financially stable country, falls behind other European countries when it comes to equipping schools with new technology (König et al., 2020). The financial situation of some schools cannot support ICT classes. Respondents are also aware of this – 43 of them mostly or completely agree with this statement. Teachers are struggling, always trying to find a way to provide students with the best possible content. However, if no investment is made towards furthering the education in Bosnia and Herzegovina in terms of equipping schools with modern equipment and educating teachers for the future, it will clearly reflect on the quality of education.

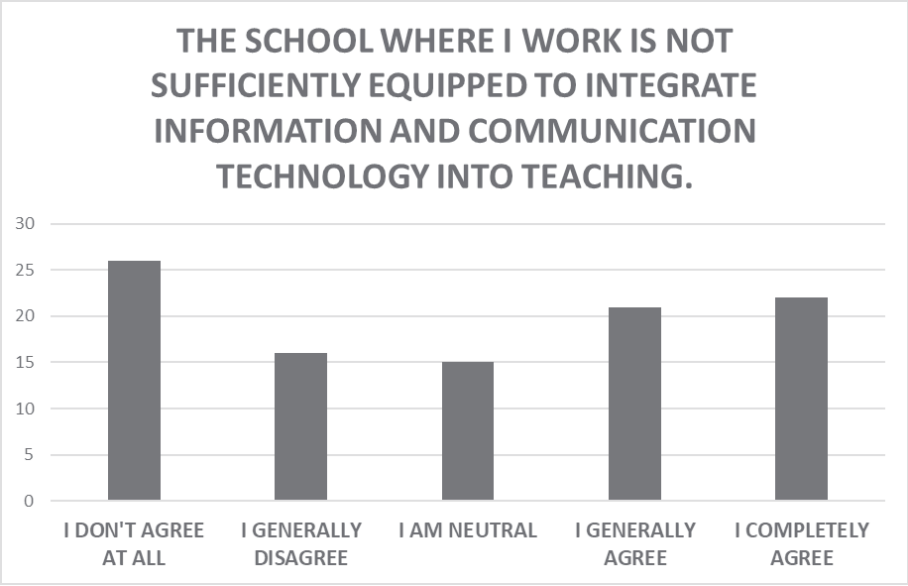

Chart 7 Level of schools' equipment for ICT integration in classes

ICT can be used for various purposes, to motivate, prepare and organize a lesson, to create personal content that will later serve teachers to explain the matter to students, for online teaching, etc. The results of the research showed that teachers, 32 of them to be precise, mostly used the new technologies to make presentations and watch videos with students, which is one of the most economical forms of using ICT. This was reaffirmed with another research. Teachers around the world, according to the global research, mostly used videos for online teaching, either downloaded from platforms such as YouTube or created personally. The reason for such results is the availability of this type of media (Rasmitadila et al., 2020), which is one of the most economical forms of ICT use. As many as 24 respondents used it to prepare and organize a lesson. New technologies were used by 14 respondents to contribute to student motivation, and only 3 respondents used ICT to communicate with students, so it can be concluded that the communication aspect is neglected. Two respondents used ICT for more complex teaching processes using LMS systems.

After all data have been analyzed, it was necessary to determine whether the hypotheses were proven. The first special hypothesis *It is assumed that teachers do not use ICT enough in Science classes* has not been proven because the research showed that teachers use ICT enough in Science classes. Another special hypothesis *It is assumed that teachers have a negative attitude towards online teaching and*

encounter many problems in organizing and implementing it has been partially proven, because most teachers have a positive attitude towards online teaching, but face many problems in implementing it. Teachers have a high level of motivation for additional training for the use of ICT and are considered sufficiently educated for its application, which means that the third special hypothesis *It is assumed that teachers consider that they are not sufficiently educated for the use of ICT in Science classes and their motivation for further training is at a low level* has not been proven. Teachers are aware of the situation in the schools where they work, so most agree with the statement that their school is not sufficiently equipped with modern technology, therefore, the fourth special hypothesis *It is assumed that teachers consider schools insufficiently equipped to introduce ICT in regular classes* has been proven. The last special hypothesis *It is assumed that the teachers who use ICT mainly use it to make presentations and watch videos with students* has been proven because teachers really do mostly use ICT to make presentations and watch videos with students. Based on the set problems and goals, tasks and hypotheses and research results, it can be concluded that the general hypothesis *Teachers have mostly negative attitudes towards the application of ICT in Science classes and the implementation of online teaching* has not been proven because teachers do not have a negative attitude towards ICT in Science classes, and most respondents also have positive attitudes towards online classes.

CONCLUSION

It is clear that ICT is an essential part of modern society, and thus of modern teaching as well. Such an opinion of the majority is valid because the technology has developed greatly in recent years. Precisely because of this progress, ICT has a great impact on students and the development of their abilities, as shown by the research conducted in our area, and as confirmed by the foreign research. While all of this is true, the integration of ICT into regular teaching is still a painstaking process, because certain conditions must be met, the advantages and disadvantages of using technology in classes must be accepted, and only in this way will ICT be properly introduced into classes educating students for the future. In the whole process of integration, along with technical needs, teachers hold an important role. They should be the process guide, informed individuals who will become the best possible organizers of the modern teaching process of which ICT is a part. For this reason, teachers need to constantly learn and strengthen their digital competencies, and put them in focus in order to transfer the same habit to students and thus achieve their goal – to train students for lifelong learning.

Of course, teachers can bring their digital competence to a higher level through education, but it is necessary to use technology every day, have a positive attitude towards it, and towards online teaching in general, which, according to the results of this research, teachers do and own. Teachers consider themselves competent for the application of all forms of ICT in teaching, and are motivated for additional education, according to the results of the research. This, however, cannot prevent the emergence of difficulties, which are mostly technical in nature and can be influenced by human action. Therefore, as stated by the respondents, schools should be better equipped with ICT.

It is important to make an effort, have the will and motivation for progress and lifelong learning and try to solve the difficulties and reduce the shortcomings in order to offer students the best possible online classes that would contribute to their training for the life ahead of them. We can conclude that there are many factors that affect the quality of online teaching as well as the use of ICT in the regular teaching process. What is crucial is the way the teaching process is conducted and the methodological skills of teachers. In the past, teachers proved to be the most important and irreplaceable link in the learning process and that everything considered important in the classroom was also important in the online environment: commitment, measure, support and care.

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PRIMJENA INFORMACIJSKO-KOMUNIKACIJSKIH TEHNOLOGIJA U NASTAVI MOJE OKOLINE

SAŽETAK

U ovome se radu razmatra primjena informacijsko-komunikacijskih tehnologija (IKT-a) u nastavi Moje okoline, ali i određeni aspekti koji se vežu za organizaciju i realizaciju online nastave u vremenu pandemije koronavirusom (COVID-19). Istraživački zadaci su pribaviti mišljenje i stavove učitelja o primjeni informacijsko-komunikacijske tehnologije u nastavi Moje okoline, odrediti načine korištenja navedenih tehnologija te oblika informacijsko-komunikacijskih tehnologija koji se najčešće rabe u nastavi Moje okoline, ali i pribaviti mišljenje učitelja o online nastavi te razmotriti probleme i nedostatke s kojima su se učitelji susretali prilikom njezine organizacije i realizacije u vremenu pandemije koronavirusom (COVID-19) u nižim razredima osnovne škole u Bosni i Hercegovini. Rezultati istraživanja pokazali su da učitelji u Bosni i Hercegovini imaju pozitivan stav prema informacijsko-komunikacijskim tehnologijama u nastavi Moje okoline i da tu tehnologiju upotrebljavaju često, iako ne konstantno, smatraju se dovoljno kompetentnim za uporabu svih oblika novih tehnologija u nastavi Moje okoline, ali su i motivirani za dodatne edukacije koje se odnose na primjenu IKT-a. Međutim, nemaju pozitivan stav prema online nastavi jer se susreću s mnogim poteškoćama u vidu tehničkih problema, nemogućnosti direktnoga kontakta s učenicima, uvida u napredak učenika i nedovoljnom opremljenosti škola za uvođenje IKT-a u redovnu nastavu, te nedostacima koji su iste ili slične prirode kao i poteškoće. Učitelji ipak, prema rezultatima istraživanja, smatraju da nove tehnologije imaju određenu vezu s razvojem novih i unapređenjem njihovih starih sposobnosti, kompetencija i vještina kod učenika, iako IKT u najvećoj mjeri rabe za izradu prezentacija i gledanje videozapisa s učenicima.

Ključne riječi: informacijsko-komunikacijska tehnologija (IKT), online nastava, COVID-19, Moja okolina, kompetencije učitelja.